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Non-Methane Organic Compound Continuous Monitoring in Cleveland and Cincinnati 1981 Ozone Monitoring Study

PEDCo-Environmental, Inc.
Cincinnati, OH

Prepared for

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PEDCo Environmental, Inc.
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Cincinnati, Ohio 45246-0100

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Contract No. 68-02-3512
Work Assignment No. 22
PN 3525-22

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NON-METHANE ORGANIC COMPOUND CONTINUOUS MONITORING IN CLEVELAND AND CONCINNATI: 1981 OZONE MONITORING STUDY

Prepared by

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16. ABSTRACT

This program was proposed to obtain Non-Methane Organic Compound (NMOC) data for days of high ozone concentration during the summer of 1981. Data were especially needed in the vicinity of Cleveland and Cincinnati to provide the needed input into the productive model that will be used to demonstrate attainment of the ambient ozone standard.

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SECTION 1.0

INTRODUCTION

Revisions to the State Implementation Plan (SIP) for ozone are required in 1982. The State of Ohio must obtain Non-methane Organic Compound (NMOC) data for days of high ozone concentrations during the summer of 1981. Data were especially needed in the vicinity of Cleveland and Cincinnati to provide the needed input into the predictive model that will be used to demonstrate attainment of the ambient ozone standard.

To obtain this data two NMOC analyzers were operated in both Cleveland and Cincinnati by the local agency. PEDCo Environmental, Inc. was contracted to assist the local agencies in the installation, start up, maintenance and quality assurance of the four analyzers.

The sites located in Cleveland were the Rickoff School site at 147th Street, and the St. Vincent's site located at Woodland and 22nd Streets. The Cincinnati sites were the University CAM site located at Vine and St. Clair Streets, and the Norwood site located at 300 Harris Avenue.

Instruction was given to the local operators on the routine operation and maintenance of the NMOC analyzers, according to the procedures published in the EMSL report EPA-600/4-81-015, March 1981. Standard Operating Procedures (SOP) (Appendix A), were supplied to the local operators.

The following sections describe the calibration procedure and quality assurance activities.

SECTION 2.0

CALIBRATION PROCEDURES

2.1 INTRODUCTION

The NMOC analyzers were scheduled to be calibrated approximately every two weeks, however, this schedule was not always met. This was primarily due to instrument malfunctions, and scheduling difficulties.

Every effort was made to calibrate each site within the prescribed time frame. However, priority was given to those instruments which were subject to downtime or drifting out of calibration. Those instruments which did not exhibit excessive drift were given a lower priority and were calibrated after the problem instruments had been serviced and calibrated.

2.2 NMOC CALIBRATION

2.2.1 Calibration Equipment

The NMOC analyzers were calibrated using EPA certified methane and propane calibration gases. The gases were certified prior to start of the project. Table 1 lists the tanks and certified concentrations.

TABLE 1. NMOC CALIBRATION GAS CONCENTRATIONS AS CERTIFIED BY U.S. EPA

Cyl. no.	Concentration
Bal 1236	746 ppm CH_4
Bal 1201	748 ppm CH_4
Bal 1222	249 ppm C_3H_8
Bal 1205	250 ppm C_3H_8

These gases were then diluted with compressed air (<0.01 ppm HC) using a porous plug dilution system. The system used throughout the project was Serial No. RTI-PE-103. Flows were measured with a Hastings NBS traceable bubblemeter.

2.2.2 Calibration Procedure

The following is the stepwise procedure used to calibrate the MSA 11-2 continuous analyzer. The analyzer should be allowed to warm up for approximately 24 hours prior to calibration.

NOTE: The analyzer was calibrated and operated with the electrometer in the subtraction mode.

All calibration data was recorded on a calibration data form (Figure 1). The calibration data has been sent to the Project Officer.

1. If this is an initial calibration, shut off the vent flow for checking; it should be checked and adjusted prior to the calibration.

2. Check the moisture drop-out traps located on the back of the analyzer for the accumulation of water. Drain any water accumulation in the second water trap toward the instrument. In the first water trap after the sample pump, maintain ½ inch to 2 inches of water. Any water accumulation higher than ½ inch should be drained to that level.

3. Quickly check the back-pressure regulator vent flow located inside the oven. Vent flow from each regulator should be 400 to 600 cc/min. These flows should be closely matched.

4. Check analyzer sample inlet pressures. The air pressure gauge on the front of the instrument should be 20 ± 1 psig. The pressure gauge between the water traps and the instrument on the back of the analyzer should be 30 ± 2 psig. The pressure gauge between the two water traps should be greater than 40 psig. If the pump will not maintain at least 40 psig, check for leaks in the water trap system or water and dirt in the sample pump.

5. Check that the range selector switch is in the 0 to 10 ppm range.

6. Disconnect the analyzer's sample line from the ambient manifold and reconnect it to the calibration system's manifold. Cap the port on the ambient manifold and any open ports on the calibration system's sample manifold.

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CALIBRATION DATA FORM FOR MSA MODEL 11-2 HYDROCARBON ANALYZER

Site: _____
Date: _____
Analyzer S/N: _____
Analyzer off line at: _____
Analyzer on line at: _____
NOTES: _____

Snubber RTI-PE # _____
Bubble Meter # _____
Zero Air Cyl # _____
CH_4 Cyl # _____ _____ ppm
C_3H_8 Cyl # _____ _____ ppm
Temperature _____ °C
Barometric Pressure _____ " Hg

Analyzer Pot Settings: Zero NMOC _____ CH_4 _____
Span NMOC _____ CH_4 _____

Correction Factor for Temperature, Barometric Pressure, and Vapor Pressure of Water:

$$\frac{(\quad)-(\quad)}{29.92} \times \frac{298}{(\quad)} = _____ \text{ Correction factor}$$

METHANE CALIBRATION:

Dilution flow: ____ psi CH_4 Zero _____% NMOC Zero _____%

$$\frac{1000}{(\quad)} \times (\quad) = _____ \text{ SCCM Zero Air}$$

#1 Point: Pollutant pressure: _____ psi Toggles 1 2 3

$$\frac{10}{(\quad)} \times (\quad) = _____ \text{ SCCM } CH_4$$

$$\frac{(\quad)(\quad)}{(\quad)+(\quad)} = _____ \text{ ppm } CH_4$$

_____ % Chart CH_4 _____% Chart NMOC

#2 Point: Pollutant pressure: _____ psi Toggles 1 2 3

$$\frac{10}{(\quad)} \times (\quad) = _____ \text{ SCCM } CH_4$$

$$\frac{(\quad)(\quad)}{(\quad)+(\quad)} = _____ \text{ ppm } CH_4$$

_____ % Chart CH_4 _____ % Chart NMOC

#3 Point: Pollutant pressure: _____ psi Toggles 1 2 3

$$\frac{10}{(\quad)} \times (\quad) = _____ \text{ SCCM } CH_4$$

$$\frac{(\quad)(\quad)}{(\quad)+(\quad)} = _____ \text{ ppm } CH_4$$

_____ % Chart CH_4 _____% Chart NMOC

Figure 1.

#4 Point: Pollutant pressure: _____ psi Toggles 1 2 3

$\frac{10}{(\quad)} \times (\quad) =$ _____ SCCM CH_4

$\{\quad\}\{\quad\} \div (\quad) =$ _____ ppm CH_4

_____ % Chart CH_4 _____ % Chart NMOC

CH_4 SLOPE: _____ INTERCEPT: _____ CORR: _____

NMOC CALIBRATION:

Dilution flow: ____ psi CH_4 Zero _____% NMOC Zero ____ %

$\frac{1000}{(\quad)} \times (\quad) =$ _____ SCCM Zero Air

#1 Point: Pollutant pressure: ____ psi Toggles 1 2 3

$\frac{10}{(\quad)} \times (\quad) =$ ____ SCCM C_3H_8

$\{\quad\}\{\quad\} \div (\quad) =$ ____ ppm C_3H_8

____ % Chart CH_4 ____ % Chart NMOC

#2 Point: Pollutant pressure: ____ psi Toggles 1 2 3

$\frac{10}{(\quad)} \times (\quad) =$ ____ SCCM C_3H_8

$\{\quad\}\{\quad\} \div (\quad) =$ ____ ppm C_3H_8

____ % Chart CH_4 ____ % Chart NMOC

#3 Point: Pollutant pressure: ____ psi Toggles 1 2 3

$\frac{10}{(\quad)} \times (\quad) =$ ____ SCCM C_3H_8

$\{\quad\}\{\quad\} \div (\quad) =$ ____ ppm C_3H_8

____ % Chart CH_4 ____ % Chart NMOC

#4 Point: Pollutant pressure: ____ psi Toggles 1 2 3

$\frac{10}{(\quad)} \times (\quad) =$ ____ SCCM C_3H_8

$\{\quad\}\{\quad\} \div (\quad) =$ ____ ppm C_3H_8

____ % Chart CH_4 ____ % Chart NMOC

NMOC SLOPE: _____ INTERCEPT: _____ CORR: _____

Figure 1 (continued)

7. Supply an atmosphere of the zero standard to the manifold at a flow rate that is 20 to 50% greater than the analyzer's sample flow demand. DO NOT PRESSURIZE THE ANALYZER'S SAMPLE INLET. The test atmosphere must contain an ambient level of oxygen and must not contain more than 0.1 ppmC TOC.

8. Adjust the analyzer's zero controls for both channels to the desired baseline responses. A 5% of full scale positive offset on the recording device is recommended to observe any negative drift. Use either the analyzer's zero pots or the recorder's controls to obtain the offset. Ensure that the responses from both channels are equal before recording the responses on the calibration data sheet.

9. Supply an atmosphere of methane standard to the calibration manifold at a flow rate that is 20 to 50% greater than the analyzer's sample flow demand. The methane concentration should be between 70 and 90% full scale.

10. Adjust span pot #2 (which controls CH_4 response from FID #2) to provide the analyzer response calculated as follows:

$$\text{Response} = \frac{\text{Sample concentration}}{\text{URL}} \times \text{url} + \text{Zero offset}$$

where

Response = Response of the recording device measuring the analyzer output in recording device units.

Sample concentration = Concentration of the calibration standard delivered to the analyzer in ppmC.

URL = The upper range limit of the analyzer in ppmC.

url = The upper range limit of the recording device in recording device units.

Zero offset = The amount the recording device response is set above the zero baseline while the analyzer is measuring the zero calibration standard (in recording device units).

11. If step 10 results in a span pot setting greater than 300, decrease pressure to H_2 gauge #2 until the CH_4 response has increased to a point where the span pot can be reduced to about 250. If the span pot setting is less than 200, increase pressure to H_2 gauge #2 until the CH_4 response has decreased to a point where the span pot can be increased to about 250. DO NOT EXCEED 9.0 psig H_2.

NOTE: IF THE FID RESPONSE INCREASES WHEN INCREASING HYDROGEN PRESSURE, THE BURNER IS OPERATING ON THE WRONG

SIDE OF ITS PEAK RESPONSE CURVE. CONTINUE INCREASING HYDROGEN PRESSURE UNTIL RESPONSE STARTS TO DECREASE AND THE CORRECT SPAN POT SETTING IS OBTAINED.

12. Set span pot #1 NMOC to the same dial setting (not response) as span pot #2.

13. Repeat steps 7, 8, 9, 10, 11, and 12 if span pot adjustments were necessary or if hydrogen pressure gauge #2 was adjusted.

14. Continue sampling the methane standard. For the FIDs to be balanced, the NMOC response must be within ±1.0% of the zero response obtained in step 8. If the FIDs are balanced, go to step 16.

15. Balance detectors: If the FIDs are not balanced:

    (a) Check that both span pots are dialed to the same setting.

    (b) Locate the range change board (inside the electrometer assembly located in the oven) and rotate the balance controls of channels 1 and 2 (accessible through holes in the electrometer cover) to their maximum clockwise position. Make adjustments quickly to minimize heat loss!

    (c) Record both hydrogen pressure gauge readings. Adjust hydrogen pressure gauge #1 until the NMOC response to the methane standard equals the earlier NMOC response to the zero standard (step 8).

        Do not adjust the hydrogen pressure outside the 5 to 9 psig range. Increase hydrogen pressure to decrease NMOC response, or vice versa. See the note in step 11.

    (d) If balance is achieved, repeat steps 7 through 15.

    (e) If balance is not achieved by step c, adjust the NMOC hydrogen pressure (gauge #1) or both hydrogen pressure, if necessary, to get as close to balance (NMOC response within ± 1% of NMOC zero response) as possible. Do not exceed the 5 to 9 psig hydrogen pressure range. Then, using the balance controls on the range change board located inside the electrometer (accessible through holes in the electrometer cover), rotate the channel #2 balance control counter-clockwise to increase the NMOC response, or rotate the channel #1 balance control counter-clockwise to decrease the NMOC response. Repeat steps 7 through 14.

16. After the FIDs are balanced, record responses on the Calibration Data Sheet. Determine the CH_4 channel's response to three additional concentrations of the methane standard that are spaced approximately equally over the analyzer range. (The NMOC

channel's response should remain equal to the earlier response to zero standard.) Record the CH_4 and NMOC channel's responses (from the recording device) on the data sheet. Using a calculator, perform a least squares linear regression corresponding calibration concentrations. The calibration concentrations should be in units of ppmC and should be entered into the calculator as the independent variable X. The CH_4 channel's response should be in units of the recording device and should be entered as the dependent variable Y. A correlation coefficient (r) of 0.9996 or better verifies that the CH_4 response is linear. (If the response is not linear, plot the data and determine if an error has been made in data entry or in determination of calibration concentration.) Obtain the slope and intercept of the regression and record the equation in the following form:

CH_4 Response = CH_4 Slope x Methane concentration + CH_4 Intercept

where

CH_4 Response = Analyzer's CH_4 channel reading in recording device units (see note following step 10).

CH_4 Slope = Regression slope in recording device units per ppmC.

Methane concentration = Calibrated methane concentration in ppmC.

CH_4 Intercept = Regression intercept in recording device units.

Post the CH_4 channel's multipoint calibration curve equation on the analyzer's recording device and also on the Calibration Data Sheet.

17. Supply an atmosphere of propane standard to the calibration manifold at a flow rate that is 20 to 50% greater than the analyzer's sample flow demand. The propane concentration should be between 70 and 90% of full scale.

18. Adjust span pot #1 (which controls NMOC response from FID #1) to provide the desired analyzer response.

19. If an adjustment is made in step 18, recheck the NMOC channel's response to the zero standard and adjust zero pot #1 if necessary. Record the stable zero responses from the NMOC and CH_4 channels. Sample the propane standard, and again record the stable responses to propane. (CH_4 response should be equal to the earlier response to zero air.)

20. Determine the NMOC channel's response to three additional concentrations of the propane standard that are spaced approximately equally over the analyzer range. (The CH_4 channel's response should remain equal to the earlier response to zero standard.) Record the NMOC and CH_4 channel's responses (from the recording device) on the Calibration Data Sheet. Using a calculator, perform a least squares linear regression of the NMOC channel's

response (to propane and zero standards) and the corresponding propane calibration concentrations. The calibration concentrations should be in units of ppmC and should be entered as the dependent variable Y. A correlation coefficient (r) of 0.9996 or better verifies that the NMOC response is linear. (If the response is not linear, plot the data and determine if an error has been made in data entry or in determination of calibration concentration.) Obtain the slope and intercept of the regression and record the equation in the following form:

NMOC Response = NMOC Slope x NMOC Concentration + NMOC Intercept

where

NMOC Response = Analyzer's NMOC channel reading in recording device units (see note following step 10).

NMOC Slope = Regression slope in recording device units per ppmC.

NMOC Concentration = Calibrated NMOC concentration in ppmC.

NMOC Intercept = Regression intercept in recording device units.

Post the NMOC channel's multipoint calibration curve equation on the analyzer's recording device and on the Calibration Data Sheet.

21. Disconnect the analyzer's sample line from the calibration system's manifold and reconnect it to the ambient manifold.

22. Be certain that the station log book, strip charts, etc. are properly dated and signed.

SECTION 3

QUALITY ASSURANCE PROGRAM

3.1 INTRODUCTION

Throughout the project several quality assurance activities were performed. These included a daily zero and span check, a two point precision check that was performed twice a week, two systems audits that were performed by the EPA contractor Research Triangle Institute (RTI) during the project, and a data validation, performed on the data before it was reduced. The following sections will detail the above mentioned QA activities.

3.2 ZERO AND SPAN CHECKS

Each day during the project the monitoring sites were visited by the local operator to perform the daily checks. These checks were recorded on the Daily Check Sheet.

The zero/span system utilized a needle flow controller and a system of "quick connect" valves to connect the appropriate cylinder to the analyzer. The zero and span values obtained were marked on the strip chart and recorded in the operators log book and on the Daily Zero and Span Data Sheet (Figure 2). Any time the zero or span values were ±10 percent of the calibration zero (including 5% offset) or span values, the local operator contacted the PEDCo project manager in Cincinnati and then the instrument was recalibrated.

All zero and span data has been sent to the project officer in a separate volume.

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DAILY ZERO - SPAN DATA SHEET

SITE: _____ ANALYZER CALIBRATED __/__/80 BY: _____
ANALYZER S/N: _____ NOTES _____
ZERO AIR CYL #: _____
SPAN GAS CYL #: _____

DATE:														
CHANNEL #1 ZERO														
IS ZERO VALUE * WITHIN 10% LIMITS?														
CHANNEL #2 ZERO														
IS ZERO VALUE * WITHIN 10% LIMITS?														
CHANNEL #1 SPAN														
IS SPAN VALUE * WITHIN 10% LIMTS?														
CHANNEL #2 SPAN														
IS SPAN VALUE * WITHIN 10% LIMITS?														
OPERATOR'S NAME														

NOTE: ALL VALUES ARE % OF CHART GRAPH CHART VALUES ON REVERSE SIDE

*IF NO: CALL PROJECT MANAGER, E. MULLIN, IMMEDIATELY AT (513) 782-4700.

Figure 2. Zero and Span Data Sheet.

DATE: _____

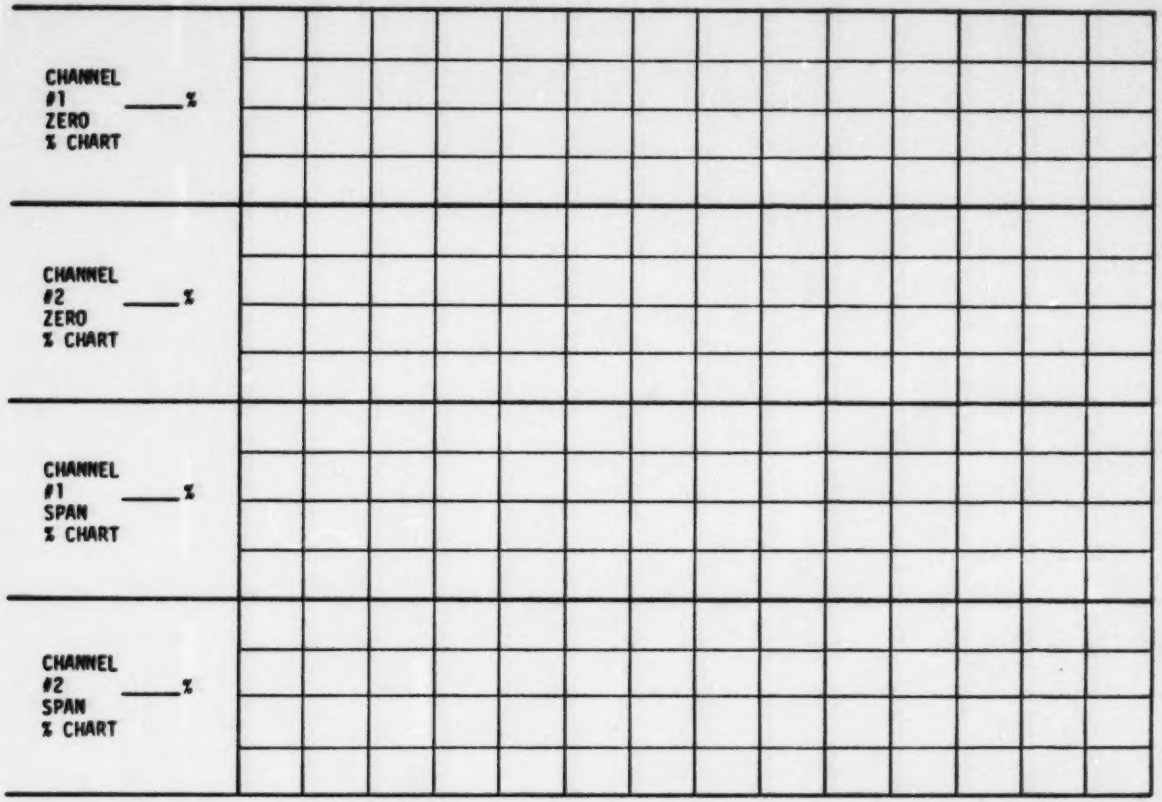


Figure 2 (continued)

3.3 PRECISION CHECKS

A two point precision check for the NMOC analyzers was carried out at each site twice a week. These checks were performed after 9 a.m. EST and on Mondays and Thursdays. The precision check data was recorded on Precision Check Data Forms (supplied by U.S. EPA). These data are tabulated in Appendix B. The precision check data was used in addition to the zero and spans as an indicator for when recalibration was necessary.

3.4. SYSTEMS AUDIT

The NMOC monitoring network was audited twice during the study period by the EPA contractor Research Triangle Institute (RTI). Table 2 lists the audit results for the sites. Only the St. Vincent site was found to have a response greater than 15 percent of the audit value. The instrument was recalibrated the following day.

3.5 DATA VALIDATION AND AUDIT

PEDCo's field operator removed, on a bi-weekly basis, the strip charts from each of the four instruments. The data was then validated and turned over to the local agency for reduction and entry into the State's data base.

Every effort was made to accomplish this task within a two-week period, however, instrument malfunctions prevented the field operator from keeping to the bi-weekly schedule.

Data was invalidated when the zero, span or precision point data were found to have drifted by more than fifteen percent.

TABLE 2. NMOC AUDIT SUMMARY

Site/date	CH_4			NMOC		
	Audit value, ppm	Response, ppm	Percent diff.	Audit value, ppm	Response, ppm	Percent diff.
Rickoff School 6/11/81	0.00	0.06	--	0.00	0.03	--
	0.98	1.00	+2.0	0.33	0.34	+1.5
	2.09	2.12	+1.4	0.65	0.66	+1.7
	3.99	4.07	+2.0	1.27	1.31	+3.1
	6.07	6.25	+2.9	1.94	1.98	+2.1
	9.33	9.41	+0.86	3.04	3.11	+2.3
Rickoff School 8/14/81	0.00	-0.09	--	0.00	-0.01	--
	0.99	0.89	+10.1	0.32	0.30	-6.3
	2.02	1.90	-5.9	0.65	0.64	-1.5
	3.86	3.74	-3.1	1.23	1.24	+0.8
	5.84	5.73	-1.8	1.86	1.88	+1.1
	8.90	8.65	-2.8	2.84	2.85	+0.4
St. Vincents 6/11/81	0.00	0.00	--	0.00	0.00	--
	0.97	0.95	-1.95	0.31	0.35	+12.2
	2.09	2.15	+2.9	0.66	0.77	+16.7
	3.97	4.20	+5.8	1.28	1.43	+11.7
	5.96	6.35	+6.5	1.95	2.15	+10.3
	9.47	9.48	+0.1	3.06	Off scale	--
St. Vincents 8/14/81	0.00	0.00	--	0.00	-0.02	--
	0.96	0.94	-2.08	0.31	0.30	-3.2
	2.03	2.01	-0.99	0.65	0.64	-1.5
	3.95	3.97	+0.51	1.26	1.26	0.00
	6.07	6.06	-0.16	1.94	1.92	-0.91
	8.99	9.14	+1.79	2.88	2.88	0.00
University CAM Site 6/23/81	0.00	0.00	--	0.00	0.00	--
	1.00	1.00	0.0	0.32	0.32	0.0
	2.05	2.03	-0.98	0.65	0.66	+1.54
	3.88	3.98	+2.5	1.24	1.25	+0.8
	5.98	6.06	+1.3	1.94	1.96	+1.0
	9.44	9.50	+0.6	3.05	3.07	+0.7
University CAM Site 8/11/81	0.00	0.02	--	0.00	0.01	--
	0.96	0.98	+2.08	0.31	0.33	+6.06
	2.00	2.04	+2.0	0.65	0.68	+4.6
	3.87	4.00	+3.36	1.28	1.31	+2.3
	6.01	6.13	+2.0	1.99	2.00	+0.5
	9.28	9.32	+0.43	2.96	2.92	+0.43

(continued)

TABLE 2 (continued)

Site/date	CH_4			NMOC		
	Audit value, ppm	Response, ppm	Percent diff.	Audit value, ppm	Response, ppm	Percent diff.
Norwood Site 6/23/81	0.00	0.00	--	0.00	0.00	--
	0.99	1.02	+3.0	0.32	0.00	--
	2.04	2.08	+1.96	0.65	0.66	+1.5
	4.45	4.49	+0.9	1.27	1.29	+1.6
	6.79	6.74	-0.7	1.93	1.95	+1.0
	9.04	9.18	+1.5	2.89	2.91	+0.7
Norwood Site 8/12/81	0.00	0.12	--	0.00	0.01	--
	0.93	0.87	-6.45	0.30	0.32	+6.67
	2.01	1.90	-5.47	0.64	0.66	+3.13
	3.92	3.82	-2.55	1.25	1.30	+4.00
	5.92	5.87	-0.84	1.89	1.96	+3.70
	8.85	8.64	-2.37	2.17	2.23	+2.77

SECTION 4

SITE OPERATION SUMMARY

4.1 RICKOFF SCHOOL SITE

The NMOC analyzer at this site was initially calibrated and put on line on June 11, 1981. The instrument operated throughout the study without any problems with the exception of a one week period in late June. The flames went out on June 17 and were not able to be relit until June 19. It was determined that this problem was due to a pump malfunction which caused fluctuating pressures.

On June 22 there was a power failure which caused the loss of approximately one day's worth of data. After these problems were corrected the analyzer operated without incident.

4.2 ST. VINCENT'S SITE

The St. Vincent's site was initially calibrated on June 4, 1981. The only problem experienced at this site was the failure of the temperature control board for the oxidizer. A new control board was ordered on July 1, 1981 and installed on July 14, 1981. After this was corrected there were no other problems at this site.

4.3 UNIVERSITY CAM SITE

The University CAM site was initially calibrated and put on line on June 1, 1981. This site operated without any major problem for the entire study period. The only minor problem was with the NMOC strip chart on June 2, 1981.

4.4 NORWOOD SITE

The Norwood site was initially calibrated and put on line on June 8, 1981. The site operated without any major problems until August 4, 1981. At this time the instrument drifted out of balance. Due to scheduling conflicts the analyzer was not recalibrated until August 10, 1981.

On September 4, 1981 several hours of data were lost when the CH_4 channel strip chart was allowed to run out.

The air conditioner at the site went out on September 25, 1981. The analyzer was shut down until September 26 to prevent damage to the analyzer due to overheating.

Other than these few problems, the analyzer operated throughout the study period.

APPENDIX A

LOCAL OPERATORS STANDARD OPERATING PROCEDURES (SOP)

ZERO AND SPAN CHECK
STANDARD OPERATING PROCEDURE (SOP)
MSA-11-2 NMOC ANALYZER

After completing the daily checklist, begin the zero and span check according to the following stepwise procedure.

1. Check moisture trap No. 1 on the side of the instrument. If it contains more than 1" of water, open valve SLOWLY and drain to a level of 1/4". Do not drain completely.

2. Check moisture trap No. 2, also on the side of the instrument. If it contains more than 1/2" of water, open the toggle valve and drain.

3. Check both pressure gauge (No. 1 and No. 2). No. 1 should read approximately 40 psig. No. 2 should read 10 psig less than No. 1, adjust No. 2 if it does not.

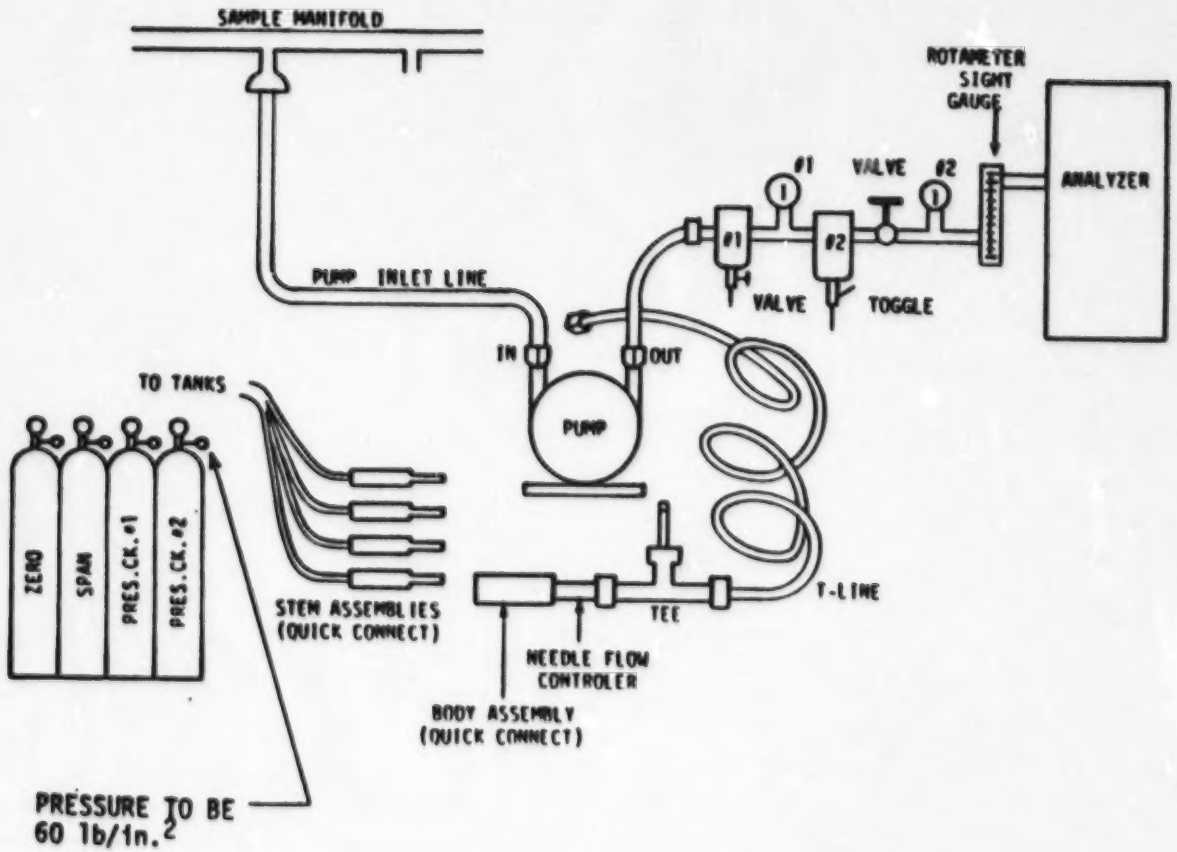
4. Disconnect the "pump inlet" line from the sample manifold to the vacuum side of the pump. Then connect the "T-line" to the same fitting. CAUTION: Do not over-tighten the connection, finger tight and then a 1/4 turn with the wrench should suffice.

5. Connect the zero stem to the "quick connect" side of the "T-line". Check for excess flow through the open end of the "T-line". Flow through the "T-line" may be increased by turning the knob on the face of the regulator clockwise. Decrease the flow by turning the knob counter-clockwise.

6. Allow sufficient time (approximately 5 to 10 minutes) for the analyzer to stabilize. Record the zero value on the daily checklist, the daily zero/span data sheet and plot the value on the zero/span chart. Note - the pressure on the span and zero tank should be 60 $lb/in.^2$

7. Disconnect the zero stem and connect the SPAN stem to the "T-line". Check for excess flow through the open end of the "T-line". Flow through the "T-line" may be increased by turning the knob on the face of the regulator clockwise. Decrease the flow by turning the knob counter-clockwise.

8. Allow sufficient time (approximately 5 to 10 minutes) for the analyzer to stabilize. Record the span value on the daily checklist, the daily zero/span data sheet and plot the value on the zero/span chart.


SAMPLE MANIFOLD
ROTAMETER SIGHT GAUGE
#1
VALVE
#2
ANALYZER
PUMP INLET LINE
#1
#2
VALVE
TOGGLE
IN
OUT
PUMP
TO TANKS
ZERO
SPAN
PRES.CK.#1
PRES.CK.#2
STEM ASSEMBLIES (QUICK CONNECT)
T-LINE
TEE
NEEDLE FLOW CONTROLER
BODY ASSEMBLY (QUICK CONNECT)
PRESSURE TO BE 60 lb/in.2

9. If either value for both Channel 1 and Channel 2 are off by more than the 10 percent indicated on the control chart, call the PEDCo Project Manager, Ed Mullin (513) 782-4700 immediately.

10. Disconnect the SPAN stem from the "T-line". If a precision check is to be performed at this time, continue with the SOP for precision checks, if not, then proceed to step 11.

11. Disconnect the "T-line" from the vacuum side of the pump. Connect the pump inlet line to the pump fitting. CAUTION: Do not overtighten the connection, finger tight and a 1/4 turn with the wrench should suffice.

12. Label both zero and span points on the strip charts, record the time and date and sign both strip charts.

PRECISION CHECK
STANDARD OPERATING PROCEDURE

The following procedure for precision checks is to follow step 10 of the ZERO and SPAN check SOP.

1. Connect the precision check gas cylinder No. 1 (Precis. Ck. No. 1) stem to the quick connect side of the "T-line". Check for excess flow through the open end of the "T-line". Flow through the "T-line" may be increased by turning the knob on the face of the regulator clockwise. Decrease the flow by turning the knob counter-clockwise. Allow sufficient time (approximately 5 to 10 minutes) for the analyzer to stabilize. Record the precision check point No. 1 valve on the form and label the strip charts. Note - the pressure for the precision span tanks should be 60 $lb/in.^2$

2. Disconnect the Precis. Ck. No. 1 stem and connect the Precis. Ck. No. 2 stem to the "T-line". Check for excess flow through the open end of the "T-line". Flow through the "T-line" may be increased by turning the knob on the face of the regulator clockwise. Decrease the flow by turning the knob counter-clockwise. Allow sufficient time (approximately 5 to 10 minutes) for the analyzer to stabilize. Record the precision check point No. 2 valve on the form and label the strip charts.

3. Disconnect the Precis. Ck. No. 2 stem from the "T-line".

4. Disconnect the "T-line" from the vacuum side of the pump. Connect the "pump inlet" line to the pump fitting. CAUTION: Do not overtighten the connection, finger tighten and a 1/4 turn with the wrench should suffice.

5. Label both precision points on the strip charts, record the time and date, and sign both strip charts. NOTE: If a zero and span check was also performed, label these points on the strip charts.

RELIGHTING BURNER
STANDARD OPERATING PROCEDURE

If the flame out indicator is ON (the light will be on), the burner(s) will need to be relit. The following stepwise procedure should be completed before calling the PEDCo Project Manager, Ed Mullin (513) 782-4700. If the burner does not relight easily, call the PEDCo Project Manager.

1. Adjust the AIR regulator (on the face of the instrument) to 5 to 10 psig.

2. Press the IGNITION button (also the flame out indicator) for a count of three. If the burner has been out a while, it will take several attemps to successfully relight the burner.

3. If the burner does not ignite on the first try, repeat 3 or 4 more times. NOTE: It will take several seconds for the light to go out after the burner ignites.

4. Adjust the AIR regulator to 20 psig.

5. Record on all the strip charts which channel was relit and when.

APPENDIX B

PRECISION CHECK PROGRAM

Site: A. J. Rickoff School

Week of	Precision check No.	Cylinder No. LL 3710 NMOC, (ppm)	Cylinder No. LL 3710 CH_4, (ppm)
6/29/81	1	0.54	1.52
7/6/81	1	0.64	1.66
	2	0.54	1.64
	3	0.54	1.64
7/13/81	1	0.62	1.56
	2	0.53	1.57
7/20/81	1	0.61	1.45
	2*	0.50	1.61
7/27/81	1	0.52	1.55
	2	0.47	1.73
8/3/81	1	0.49	1.61
	2	0.50	1.75
8/10/81	1	0.46	1.61
	2	0.44	1.61
	3*	0.58	1.50
	4	0.52	1.41
8/17/81	1	0.44	1.46
	2	0.42	1.52
8/24/81	1	0.41	1.56
	2	0.40	1.61
8/31/81	1	0.42	1.41
	2	0.55	1.63

Precision gas cylinder was empty.

Site: St. Vincent's

Week of	Precision check No.	Cylinder No. LL 3709 NMOC, (ppm)	Cylinder No. LL 3709 CH_4, (ppm)
6/15/81	1	0.45	1.59
6/22/81	1	0.46	1.61
	2	0.42	1.63
6/29/81	1	0.41	1.60
	2	0.44	1.53
	3*	0.51	1.64
7/6/81	1	0.50	1.70
	2	0.49	1.68
7/13/81	1	0.47	1.71
	2	0.48	1.76
7/20/81	1	0.46	1.78
	2	0.47	1.73
	3*	0.52	1.62
7/27/81	1	0.52	1.68
	2	0.50	1.68
8/3/81	1	0.51	1.63
	2	0.52	1.72
8/10/81	1	0.51	1.71
	2	0.50	1.56
8/17/81	1	0.50	1.77
	2	0.50	1.77
8/24/81	1	0.50	1.74
	2	0.47	1.73
	3	0.48	1.66
9/1/81	1*	0.53	1.67
9/14/81	1	0.49	1.70
	2	0.48	1.63
9/21/81	1	0.50	1.68
	2	0.48	1.76
	1	0.45	1.73

*New calibration relationship.

Site: University CAM

Week of	Precision check No.	Cylinder No. LL 4851 NMOC, (ppm)	Cylinder No. LL 4851 CH_4, (ppm)
6/22/81	1	0.52	1.64
	2	0.50	1.63
6/29/81	1	0.52	1.63
	2	0.53	1.59
	3	0.54	1.63
7/6/81	1	0.53	1.63
	2*	0.48	1.64
	3	0.45	1.59
7/13/81	1	0.47	1.63
	2	0.46	1.64
	3	0.47	1.60
7/20/81	1	0.46	1.59
	2	0.47	1.59
	3*	0.50	1.64
7/27/81	1	0.47	1.68
	2	0.48	1.64
	3	0.49	1.64
8/3/81	1	0.50	1.64
	2	0.48	1.63
	3	0.50	1.63
8/10/81	1	0.49	1.64
	2	0.50	1.63
	3	0.49	1.64
8/17/81	1	0.47	1.63
	2	0.52	1.64
	3	0.51	1.64
8/24/81	1	0.55	1.65
	2	0.50	1.63
	3	0.50	1.63
8/31/81	1	0.50	1.63
	2	0.50	1.63
	3	0.49	1.63
9/7/81	1	0.51	1.55
	2	0.54	1.66
	3	0.53	1.65
9/14/81	1	0.52	1.63
9/21/81	1	0.50	1.63
9/30/81	1	0.46	1.63

*New calibration relationship.

Site: Norwood

Week of	Precision check No.	Cylinder No. LL 3800 NMOC, (ppm)	Cylinder No. LL 3800 CH_4, (ppm)
6/22/81	1	0.55	1.63
	2	0.55	1.64
6/29/81	1	0.56	1.59
	2	0.55	1.53
	3	0.52	1.50
	4	0.55	1.54
7/6/81	1	0.55	1.56
	2*	0.55	1.62
	3	0.55	1.62
7/13/81	1	0.54	1.67
	2	0.53	1.55
	3	0.47	1.60
7/20/81	1	0.54	1.56
	2*	0.53	1.62
	3	0.54	1.62
	4	0.55	1.60
7/27/81	1	0.57	1.60
	2	0.53	1.59
	3	0.54	1.59
8/3/81	1	0.55	1.59
	2	0.35	1.66
	3	--	1.57
8/10/81	1	--	1.59
	2*	0.57	1.45
	3	0.53	1.49
8/17/81	1	0.51	1.49
	2	0.50	1.51
	3	0.52	1.47
8/24/81	1	0.55	1.44
	2	0.52	1.46
	3	0.54	1.50
8/31/81	1	0.56	1.50
	2	0.53	1.50
	3	0.53	1.55
9/6/81	1	0.53	1.50
	2	0.54	1.47
	3	0.53	1.65
9/14/81	1	0.55	1.50
9/21/81	1	0.54	1.49

*New calibration relationship.